(12) UK Patent Application (19) GB (11) 2 203 324 (13) A

(43) Application published 19 Oct 1988

(21) Application No 8808840

(22) Date of filing 14 Apr 1988

(30) Priority data
(31) 8709173 (32) 16 Apr 1987 (33) GB

(71) Applicant
Cigarette Components Limited

(Incorporated in United Kingdom)

Arden Grove, Harpenden, Herts, AL5 4SJ

(72) Inventor
Ernest Brian Hayes

(74) Agent and/or Address for Service
Reddie & Grose
16 Theobalds Road, London, WC1X 8PL

(51) INT CL⁴
A24D 3/04

(52) Domestic classification (Edition J):
A2C EH

(56) Documents cited
GB A 2160756 GB A 2154423 GB A 2150409
GB A 2101869 GB 1198772 EP A1 0151732
EP A1 0101173 US 4342322

(58) Field of search
A2C
Selected US specifications from IPC sub-class A24D

(54) Ventilated cigarette filter

(57) A ventilated tobacco smoke filter comprising an upstream core component (1) of relatively high pressure drop longitudinally of the filter, a downstream core component (2) of relatively low pressure drop longitudinally of the filter, and a common full or partial wrap (4) which extends along and around or partially around said core components and provides for ventilation of the filter downstream of the upstream core component, the downstream core component providing a longitudinal passage or passages (3) for substantially free unfiltered flow of smoke therethrough.

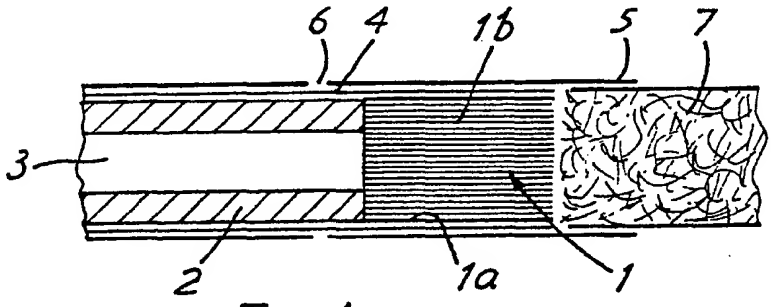

FIG. 1

GB 2 203 324 A

VENTILATED CIGARETTE FILTER

The present invention relates to ventilated tobacco smoke filters, and provides such a filter comprising an upstream core component of relatively high pressure drop longitudinally of the filter, a downstream core component of relatively low pressure drop longitudinaly of the filter, and a common full or partial wrap which extends along and around or partially around said core components and provides for ventilation of the filter downstream of the upstream core component, the downstream core component providing a longitudinal passage or passages for substantially free unfiltered flow of smoke therethrough.

The downstream core component could be a rod or plug with a periphery conformed to provide one or more external passages extending from end to end thereof; in this case the upstream and downstream core components could abut or be longitudinally spaced, and the ventilation could be directly into the peripheral passage or passages and/or into a space between upstream and downstream core components and/or further downstream of the downstream core component. Instead, or in addition, the downstream core component could provide one or more internal passages from end to end thereof for substantially free unfiltered smoke flow, e.g. it could be tubular. Where the downstream core component has no peripheral passages and is of air-impermeable material, ventilation will be further downstream of the downstream core member and/or into a space between it and the upstream core member. Where the downstream core component has no peripheral passages and is a tube of air-permeable material, ventilation may be laterally through the tube wall into the longitudinal passage; the downstream core component will then provide the substantially free smoke flow longitudinally.

Apart from the end to end peripheral and/or internal free smoke flow passage(s), the downstream core component could have one or more peripheral passages

extending from one (e.g. downstream) end and terminating or blocked short of its other end, with ventilation into such part length peripheral passage(s). In some embodiments the downstream core component is preferably of inherently smoke-impermeable material and is preferably in the form of an externally fluted or grooved rod or tube or of a plain tube; in other embodiments the downstream core member is a plain tube of air-permeable material, e.g. of bonded cellulose acetate tow - preferably drawn down in tube manufacture so as to substantially de-crimp the filaments.

The wrap may be a complete wrap of porous or perforate material of substantially uniform air-permeability along its length. It may instead be a partial wrap comprising one or more strips the or each of which extends only partially around the filter core to leave between longitudinal strip edges a gap or gaps extending longitudinally of the filter and into which free ventilation can occur; the gap or gaps will usually be open at both ends, extending continuously the full length of the partial wrap.

The upstream core component can be substantially air-impermeable radially of the filter and is preferably radially impermeable over the whole of its cross section. It is preferably a unitary body, except for any outer wrapper which may form part of it. It is preferably substantially uniform over the whole of its cross section. It preferably occupies fully and uninterruptedly the whole of the cross section (other than that occupied by the common wrap or partial wrap) of the filter. It thus suitably comprises a unitary substantially uniform plug of circular cross section which may include its own wrap.

In a filter cigarette, the filter according to the invention will normally be incorporated with the high pressure drop core component towards the tobacco rod and with ventilation into the filter downstream of the high pressure drop component towards the buccal end. The filter will normally be incorporated in a filter cigarette by means of a ventilating tipping overwrap, which will usually have ventilating perforations disposed downstream of the

high pressure drop core component. The ventilating tipping overwrap may be the previously mentioned common wrap for the core components, but more usually the core components will be pre-formed into a sub-assembly with the common wrap, and this sub-assembly subsequently incorporated in a filter cigarette by means of the ventilating tipping overwrap. The sub-assembly is preferably produced continuously, with the continuous rod being cut into finite lengths as it is produced; these finite lengths will usually be a multiple of the eventual individual filter lengths; in the production of filter cigarettes, a double length rod will usually be aligned longitudinally between two tobacco rods, joined thereto by a double length tipping overwrap, and the assembly then cut centrally to form two filter cigarettes.

Various structures and materials are possible for the upstream high pressure drop core component. It is currently preferred to employ plastics film, longitudinally corrugated substantially without fibrillation so as to remain air-impermeable, and gathered laterally to form a filter plug which is permeable longitudinally, along the corrugations, but substantially impermeable radially. The gathered corrugated film may be bonded to itself to provide a self-supporting and dimensionally stable rod or plug, but more usually it will be retained in rod form by means of a wrapper. The plastics film is suitably of polyethylene.

The downstream low pressure drop core component may be of various forms. It is preferably a unitary body, e.g. a plastics extrusion: it might thus be an impermeable plug or rod having peripheral grooves extending fully (and optionally with others extending partially) from one end to (or towards) the other, or it might be a tube which could also have external peripheral grooves extending fully (or partially) from one end to (or towards) the other. It can be a plain tube of material which is air-permeable - at least radially through the tube wall if not longitudinally.

The upstream core component, and the filter as a whole, are preferably of low inherent mechanical retention. In particular, in

filters and filter cigarettes according to the invention, the percentage air-dilution via the filter is preferably greater than the percentage "non-ventilated" or "enclosed" tar retention of the filter - i.e. that measured for an equivalent filter or cigarette with air dilution via the filter prevented. The percentage air dilution as referred to herein is the percentage by volume of ventilating air added via the filter in the total mixture delivered by the filter; thus 50% ventilation or air dilution means that in each puff there is a 50/50 volume ratio of added air to original smoke, and 40% air dilution indicates a 40/60 ratio, and so on.

The enclosed tar retention of the filter will preferably be under 40%. The upstream core component will usually provide virtually all of the pressure drop and tar retention of the filter: where there is ventilation radially through the wall of a plain tubular downstream core component, the upstream component will still provide virtually all of the tar retention.

The filter according to the invention can achieve the usually irreconcilable objectives of on the one hand permitting a very high degree of air-dilution [e.g. 50% or 60% or more] to give good reduction of CO without on the other hand reducing the taste and pressure drop of the filter cigarette to unacceptably low levels. Various prior filter structures have aimed at this performance, but the filter of the present invention can achieve it to an improved degree by use of a very high pressure drop low retention upstream core component in combination with a low (usually very low) pressure drop and retention downstream core component, with high air dilution downstream of the high pressure drop component; the improved performance is obtainable with a filter which is of essentially uniform cross-section, without implants or capillary tubes etc. which have been proposed for the purpose in the past and which can

become blocked to impair the performance; the whole cross-section of the filter can be used, and the filter can be of conventional appearance. Furthermore, in view of the very high pressure drop which can be provided by the first [upstream] core component, it is relatively easy to obtain the high air dilution levels desired without having to use exceptionally porous tipping, relatively small ventilation perforations being adequate; the combination of small ventilation holes and high upstream pressure drop can prevent or reduce the escape of smoke through the ventilation holes between puffs, the latter being an undesirable phenonomen frequently encountered with prior ventilated filters.

The filter according to the invention can give improved reduction not only of CO but also of other vapour phase components such as HCN, formaldehyde etc., to give a better vapour phase/tar reduction ratio than previous filters.

It is also much easier to incorporate adsorbent [e.g. active carbon] for further vapour phase reductions in filters according to the invention [e.g. between spaced first and second core components] than is the case with previous high ventilation low retention filters.

The filter according to the invention can further include a short conventional filter plug (e.g. of gathered acetate tow or creped paper) at the very buccal end to cover the passage(s) of the said downstream core component and give a plain, unbroken conventional end appearance.

References herein to "upstream" and "downstream" core components reflect the fact that the filter would normally be employed in this orientation, with the high pressure drop component towards the tobacco rod and the low pressure drop component at or towards the buccal end. The filter could however be incorporated in a filter cigarette in the reverse orientation.

Embodiments of the invention are illustrated, by way of example

only, in the accompanying drawings, in which:-

FIGURE 1 is a schematic side elevation view, in section, of one filter according to the invention incorporated in a filter cigarette;

FIGURE 2 is a similar view of a second embodiment: and

FIGURES 3 and 4 show schematically two possible configurations of downstream core component for use in filters according to the invention.

Throughout the drawings, like reference numerals indicate like parts.

The filter of figure 1 consists of a high pressure drop, low tar retention upstream core core component 1 consisting of a plug 1b with its own wrapper 1a, plug 1b for example being of longitudinally corrugated but unfibrillated plastics film or sheet gathered with the corrugations extending longitudinally of the plug; longitudinally abutting therewith a downstream core component 2 which is a plain tube which is radially air-permeable - and is e.g. of bonded filamentary cellulose acetate tow; and a combiner wrap 4 which joins upstream and downstream core components together and which may be of porous inherently air-permeable material, or have ventilating gaps or perforations, or be only a partial wrap which extends only partially around the filter periphery to leave between its longitudinal edges a gap extending its full length.

The composite filter according to the invention of components 1, 2 and 4 is combined with wrapped tobacco rod 7, to form a filter cigarette, by means of a tipping overwrap 5 having a ring of ventilating perforations 6 around tube 2.

The embodiment of figure 2 is similar, except that the tube 2 is longitudinally spaced from upstream core component 1 to leave a cavity 8, the ventilating perforations 6 in tipping overwrap 5 being

in register with this cavity. In this embodiment, the tube 21 may be of any material, permeable or impermeable.

Figures 3 and 4 show two types of tube 2, that of figure 3 being a simple cylinder with a circular bore, and that of figure 4 having a triangular bore; the bore may of course be of any desired configuration.

In figures 1 and 2 the upstream core component 1 is a substantially uniform plug with its own wrap, occupying the whole filter section and being radially air-impermeable over the whole of its cross-section. The downstream tube 2, when it is radially permeable as in figure 1, is suitably of Transorb (Registered Trade Mark) - bonded cellulose acetate filamentary tow which is drawn longitudinally in formation of the tube to yield a densified product in which the crimp origirally present in the filaments is substantially removed.

The invention is further illustrated by the following specific examples. In the following Examples 1 to 4 the filters are as described above with reference to fig.1 or fig.2, employing a tubular component 2 of Transorb and a uniform radially impermeable plug 1 of gathered longitudinally corrugated plastics sheet in its own plugwrap 1a; in each case the extent of ventilation was 50%, and the tobacco rod was one having, in the absence of any filter, a tar delivery of 35mg, a CO delivery of 18mg, and a pressure drop of 60mm of water.

EXAMPLE 1

In this Example the filter was as shown in Fig.1, and was 20mm in length with a tube (2) 14mm long and a plug (1) 6mm long. The enclosed pressure drop of the filter (i.e. that measured with the perforations covered so as to prevent ventilation) was 82mm of water, and the tar retention was 14.5%.

EXAMPLE 2

This was as Example 1, but with a filter 25mm long and having a

tubular component (2) 15mm long and a plug (1) 10mm long. The enclosed pressure drop of the filter was 180mm of water, and its tar retention was 18.3%.

EXAMPLE 3

In this Example the filter was as shown in Fig.2 and was 22mm in length, having a tube (2) 10mm long, a plug (1) 8mm long and a cavity 8 between them 4mm long. The enclosed pressure drop of the filter was 130mm of water, and the tar retention was 16.5%.

EXAMPLE 4

In this Example the filter cigarette was as described in Example 1. At 50% air dilution, the tar yield of the filter cigarette was 14.9mg, and the CO yield was 8mg, giving a CO/tar ratio of 0.54. The pressure drop of the ventilated filter cigarette was 71mm of water.

For comparison, an equivalent tobacco rod was provided with a conventional filter having simply a 20mm long plug of cellulose acetate filamentary tow whose enclosed pressure drop was 30mm of water and whose tar retention was 30%. With 39% ventilation to give the same tar yield of 14.9mg, the CO yield was 10.2mg, so that the CO/tar ratio was 0.68; the pressure drop of this comparison ventilated filter cigarette was 62mm of water.

C L A I M S :

1. A ventilated tobacco smoke filter comprising an upstream core component which is of relatively high pressure drop longitudinally of the filter and is substantially air-impermeable radially of the filter, a downstream core component which is of relatively low pressure drop longitudinaly of the filter, and a common full or partial wrap which extends along and around or partially around said core components and provides for ventilation of the filter downstream of the upstream core component, the downstream core component providing a longitudinal passage or passages for substantially free unfiltered flow of smoke therethrough.

2. A filter according to claim 1 wherein the downstream core component is an externally fluted or grooved rod or tube or a plain tube.

3. A filter according to claim 1 wherein the upstream core component is radially impermeable over the whole of its cross section.

4. A filter according to claim 1 wherein the upstream core component comprises a unitary substantially uniform plug of circular cross section which may include its own wrap.

5. A filter according to claim 4 wherein the upstream core component comprises plastics film longitudinally corrugated substantially without fibrillation so as to remain air-impermeable and gathered laterally to form a filter plug which is permeable longitudinally but substantially impermeable radially.

A filter according to claim 1 wherein the downstream core
nent is a plain tube, ventilation being radially through the
l or into a cavity between the upstream and downstream core

7. A filter according to claim 1 wherein the common wrap comprises one or more strips the or each of which extends only partially around the filter core to leave between longitudinal strip edges a gap or gaps extending longitudinally of the filter and into which free ventilation can occur.

8. A filter according to claim 1 in which the percentage air dilution via the filter is greater than the percentage enclosed tar retention.

9. A filter according to claim 8 whose enclosed tar retention is under 40%.

10. A filter cigarette incorporating a filter according to claim 1 and having the higher pressure drop core component towards the tobacco rod with ventilation into the filter downstream thereof towards the buccal end.

Published 1988 at The Patent Office, State House, 66-71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office, Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd, St Mary Cray, Kent. Con. 1/87.

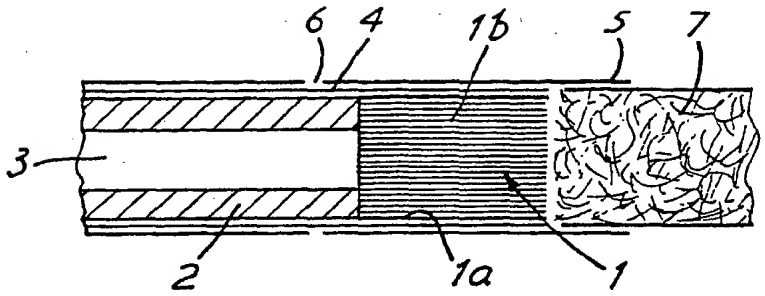

FIG. 1

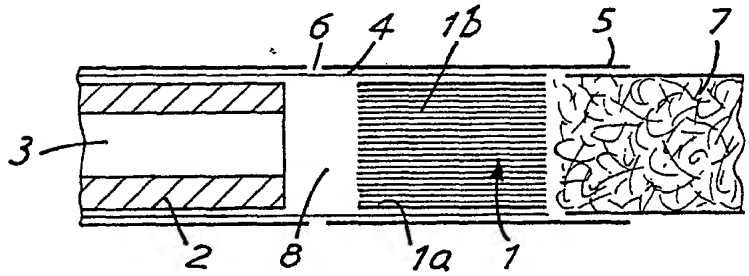

FIG. 2

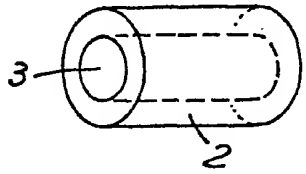

FIG. 3

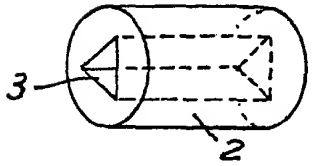

FIG. 4